

SYRON MAKES ADDRESS ON COMMERCIAL IMPORTANCE CHEMISTRY AND PHYSICS

The following paper was read by Prof. C. L. Syron, head of the department of science in the Amarillo high school, before the Teachers' Institute Wednesday.

THE COMMERCIAL IMPORTANCE OF CHEMISTRY AND PHYSICS IN THE HIGH SCHOOL.

In discussing the question of the benefit of the natural sciences in the high school, I suppose my hearers will expect me to talk of the commercial importance, but first, I wish to say a word about them from the academic standpoint.

I believe the greatest benefit to be derived from the study of sciences in the high school is the cultivation of the scientific spirit—that is the spirit of inquiry, and the spirit of the spirit of cause and effect. In chemistry and physics the students are taught to be a close observer; to pay attention to minutiae; to details; to acknowledge the overwhelming importance of care and precision. His powers of initiative and invention are stimulated, and the love for the search of truth is fostered.

When we examine attentively the facts of nature around us, we study what are called physical, as distinguished from mental phenomena. In this study it is necessary to assume the reality of this outer world of nature, and to assert that external objects exist apart from and independently of the mind of any one observing them. It is true that we become acquainted with the physical universe solely by means of our senses, but these alone do not enable us to decide whether the outer material world has a real existence or only the appearance of it. The final test of physical reality or that the material world is as real as the mental one which gives us thoughts and feelings, is the fact that the physical world remains unchanged in quantity, or fixed in amount, however, it may be measured.

Tried by this test, there are only two classes of things in the physical world—matter and energy. Out of the effort to deal with these things have grown up the two sciences of which I speak. In its most general respect, physics may be defined as the quantitative science of matter and energy. Chemistry is that part of natural science treating of the composition of matter. Knowledge of the composition of substances is obtained by three general methods—analysis, synthesis and metathesis. All the materials of this universe, both living and lifeless, are classified by the chemists as either chemical elements or chemical compounds. The compounds are quite different in their properties from the elements which compose them, and it takes a close student to prophesy their properties.

Although physics and chemistry are not new, yet are modern sciences, they have found their way into most high schools, and an increasingly large number of boys and girls are yearly engaged in their study. The question might well be asked by any of these students, why do I take up the study of chemistry and physics? Of what practical value is it to me? Aside from the discipline it gives me, is there anything that I can take away which will help me in my future life as a boy or girl with only a high school education?

The answer to this question is plain. If the study of physics and chemistry will give us a better understanding of our own bodies and their care, of our food and drink, of our clothing, of our conveyances, of sound and color, then it certainly is of use to us.

Still another reason why we should study the occult sciences, is that we may work understandingly for the conservation of our natural resources. The quantity of waste products that have been lost in the destructive distillation of coal, is criminally great. But these conditions are fast improving now, and in some cases the recovered waste products bring in more revenue than the main one.

Perhaps all you who are students of geography know that the only large sodium nitrate beds in the world are in Chili. This product, referred to as Chili saltpeter, is being rapidly diminished and the world has wondered what could be done when the supply was exhausted. But the chemists of Norway have solved the problem by their process of getting nitrogen from the air, and their product is known as Norway saltpeter. Since we know that 80 percent of the atmosphere is composed of the inert gas nitrogen, the possibilities of this process are practically limitless.

Technical chemical processes furnish man with a large part of his food; they give him material for his house, and heat and light for his comfort; they provide him with pulp from which he makes his paper, and the active principle of gall nuts and iron from which he obtains ink. They make it possible for him to have leather, and since the recent synthesis of aniline dyes, the most beautiful and royal colors may be had in the cheapest fabrics; most medicines, beverages and flavoring extracts are products of industrial chemistry, while technical knowledge is made use of in hundreds of ways in the

useful arts and trades, producing varnishes, dye-stuffs, rubber, camphor turpentine, sugars and other useful products.

Since the recent discovery and synthesis of saccharine in the Johns Hopkins laboratories the baking industry has been able to operate on a much cheaper scale, for saccharine is 500 times as sweet as sugar and only costs ten times as much.

The need of men trained in the sciences was clearly demonstrated a couple of years ago in Colorado. The difficulty grew out of the Pure Food law. Dr. Wiley gave an opinion that benzoate of soda was injurious to the human system and should not be used in food stuffs. The manufacturers of ketchup and pickles immediately protested and as a result, Congress appointed the Remson board to investigate. They gave as a result of their experiments that benzoate of soda is not injurious when used as a food preservative. And when the finding was brought as a political issue in Colorado, it was submitted to a popular vote. Instead of being able to find a committee of scientific men to investigate and recommend, they had men voting on the question who did not know benzoate of soda from sodium bicarbonate.

Recently I was consulted by a housekeeper about a physical problem of this nature. Why is it that water boils at a lower temperature here than at the sea coast; and why will a recipe for baking cake, that gives good results in Florida, not work in Amarillo? Of course this is due to the variation in air pressure, according to altitude, which every student of elementary physics knows.

It is both profitable and interesting for a boy when turning the ice cream freezer to ask himself the question, "Why does cream freeze?" and be able to solve the problem. It gives him proper food material, and makes light what would otherwise be a tiresome task. Elaborating this idea he can study the problem of how the ice was manufactured. He knows that at ordinary temperature ammonia is gaseous. He knows that a condensed liquid is allowed to expand, it will absorb heat. Then the ice problem becomes an easy one. The ammonia is condensed to a liquid, allowed to flow through pipes where it can expand, it absorbs the heat from the water tanks and ice is formed.

It is useful for the housewife to know that when soda is put in the biscuit dough, carbon dioxide is given off and the bubbles in trying to escape lift a piece of dough and make the biscuit light. Or, if she has sufficient time and energy to beat the dough two hundred times, enough air will be enclosed to secure the same result and she will have beaten biscuit of equal lightness.

It is a good thing for her to know that lime is a hygroscopic substance and, that if in a moist climate, a dish of it is placed under the piano it will keep the wires from rusting.

It is a point in economy to know that Listerine and Antiseptic Solution are identical compositions, and when buying if she asks for Listerine she gets 3 ounces for a quarter, while if she asks for the latter she gets 4 ounces for a quarter.

It is a good thing to know that water containing salt freezes at a lower temperature than pure water. To know that salt water boils at a higher temperature than pure water and that there is a proportionate rise in boiling point for each spoonful of salt added. To know that cocoa boils at a higher temperature than water, and that when attending a reception she must wait a longer time before beginning to sip chocolate than she would have to if it were tea.

To know that ivory may be cleaned with hydrogen peroxide without staining it, and to know that all iodine stains may be removed with sodium thiosulphate.

It is a good thing to know that metals expand with heat and cold. For a man who lays down the rails for a railway track, to do the work well must calculate the coefficient of expansion and leave the correct spaces between the ends of rails. Otherwise when they expand they will be forced out of position and a train possibly derailed.

To know that water increases in density with fall in temperature till 4 degrees C. is reached, when it decreases in density until 0 is reached. Thus ice remains on the top of the water and the poetical and economic catastrophe of having all the fishes killed is averted.

It is well to know that the reason table salt takes up moisture and cakes, is because of the magnesium chloride present; and that if a salt which has been freed from this hygroscopic substance is bought, that annoyance will be averted.

It helps wonderfully one's understanding of commercial and economic conditions to know that sulphur is found in large quantities in volcanic regions, because it is there formed by the union of the two gases, sulphur dioxide and hydrogen sulphate, which are emitted from the crater.

It is also useful to know that the melting point of sulphur is 56 degrees C., a little below the boiling point of water. This fact is made use of on a large commercial scale in Louisiana. There the sulphur deposits are the result of bacteriological action, and are about fifty feet below the earth's surface. Forings are made and iron pipes let down to the sulphur beds. Then these pipes are jacketed with concentric pipes; hot water is sent down; the sulphur is melted and pumped up. Because of this scientific application the sulphur industry has become of great importance in America. It is cheapened sulphur in the world's market that the Italian government had to take over the product of the laborers in the volcanic regions at an elevated price in order that the villagers might earn a living wage.

It is profitable to know that, with the exception of flavoring, country butter and oleomargarine are identical as to composition, and that it is decidedly a point of economy, if the occasion demands it, to buy oleomargarine at 20c rather than pay 40c for butter.

I recently saw advertised down town a baking powder that contained no alum. How many people in Amarillo know what the composition of alum is, or know whether it is injurious or beneficial. It has been a much discussed question in recent years, and has caused a long lawsuit in the Missouri courts. No one but a physical chemist could really know its action in solution.

One sufficient reason for placing chemistry in the secondary course lies in the fact that private and public hygiene, the message of protective medicine and sanitation, the story of pure milk and of pure water, all can logically be presented in a course that makes man the center.

The boys are taught in the laboratory a simple yet accurate method for the determination of the strength of acids and alkalis. This knowledge may be of benefit to them in their home life or as a marketable product. Young men with such a training as our high school gives are employed by governmental and commercial laboratories under the class of intelligent assistants. They will be competent to go into the Bureau of Standards to do calibration work, or to go into fertilizer works to determine the percentage of phosphates.

Then again for the boys and girls preparing for college, it is essential that they have a proper start in Physics and Chemistry. For none of our real universities offer courses suitable for beginners, and those who take up the work there for the first time are at a serious disadvantage.

Physics and Chemistry, as I said at the beginning, are not new sciences. The ancient Greek philosophers made qualitative experiments, and the Roman poet Lucretius, in *De Natura Rerum*, developed the atomic theory.

But chemistry has taken on its greatest strides in the last century, carried on by such men as Lavoisier, Gay-Lussac, Rose, Van Hoff, Pasteur, and in our own country, Smith, Noyes, Jones and Remsen—all of whom perhaps have had in mind the motto, "Seek to know the truth, and the truth will make you free."

NAVAJO SLAYER OUT ON "HONOR PAROLE"

Aztec, N. M., Dec. 21.—At liberty with only his word as his bond, a Navajo Indian, who has been practically "on honor" for more than a year, will present himself to be tried on the charge of slaying Richard Wetherill, formerly a well-known resident of Southwestern Colorado.

The Indian is Ches-chil-le-be-ga, a full-blooded Navajo, who a year ago shot down Wetherill, one of the best known Indian traders in the Southwest. The Indian was in jail at Aztec, N. M., a few weeks, but he was released without bond after giving his word of honor that he would appear for trial. For months he has roamed about the agency grounds at Shiprock, with nothing to prevent his escape to the distant mountains, where he would stand a good chance of eluding the Indian police for years. But the Indian has no thought of escape. He has given his word, and the word of a Navajo Indian is something stronger than chains or iron bars. It was the recognition of this high sense of honor among Indians that prompted the authorities of San Juan county, New Mexico, to release Ches-chil-le-be-ga, for the white men of the Southwest realize that the red man's word, once given, is never broken.

Not the least dramatic feature of the case was evidenced a few weeks ago, when John Wetherill, a brother of the slain man, visited the Navajo Indian fair at Shiprock and met the Indian roving about the agency grounds. Mr. Wetherill, who has lived for years among the Indians of the Southwest, knew the circumstances of the Indian's release, but he knew also that the Navajo would present himself for trial and that the red man was just as certainly a prisoner when bound by his word as if behind iron bars.

There is only one notable parallel to the case of Ches-chil-le-be-ga, the case of an Oklahoma Indian murderer who was released after having been found guilty of murder in the first degree and who was allowed to play

turn on the day of execution. Indian returned as he had promised and was executed with all the facilities of the white man's law. Doubt the Navajo Indian who was about the agency ground at Shiprock would present himself for trial if he had pledged his word. He realizes that at the slightest delay to receive a heavy sentence in penitentiary, for the courts of the southwest are anything but lenient in dealing with Indians who dare to offend against white men.

No sense of impending danger is noted in the impassive face of Ches-chil-le-be-ga. In a cheap gray suit "store clothes," a heavy overcoat and a slouch hat, he stalks about the agency grounds, doing tasks at the behest of Agent W. T. Shelton. Sometimes the Indian police are all on assignments that call them away from the agency, and there is nothing to prevent the Navajo from taking a horse and making his escape, but every night he returns to his log house that serves as police headquarters and jail and rolls up a blanket on the floor and sleeps the sleep of a man whose mind is untroubled by any care.

The killing of Wetherill is clouded with some mystery. The word of a man is arrayed against the word of an Indian. The Navajo claims the killing was justified, but a cowboy who was with the trader and who narrowly escaped being killed by Ches-chil-le-be-ga, says there was no reason for the shooting. Wetherill was well known throughout the Southwest. He and his brothers had lived for years in the Mesa Verde country, in Southwestern Colorado, where the discoverers of the great ruins now included in Mesa Verde National park. Of late years he had conducted a trader's store at Palo Bonito, near the famous ruins of Haco canon, at the edge of the Navajo reservation. The Indians claim that Wetherill had made many enemies among the tribe. The ill feeling culminated when, according to the Indian's accounts, the trader's cowboy "beat up" one of Ches-chil-le-be-ga's relatives and left him apparently dead.

Ches-chil-le-be-ga came upon the conscious form of his relative and avenge. He says that when he was a child his parents were killed by white men who were never punished for their crime. Unarmed, he stood down the road. He was joined, according to his story, by an old man who was traveling off the reservation and who had an old gun slung to his burro. The Indians claim Wetherill and the cowboy and, according to their story, the trader used the old gun carried by Ches-chil-le-be-ga's companion and broke

it across a rock. "He said the whole tribe ought to be killed and that he could do it," said Ches-chil-le-be-ga through an interpreter. "I went back and got a rifle, and when I came up to the white men they began firing at me. I dropped off the horse and shot Wetherill, who passed between me and his cowboy, who was the man I wanted to get. Then the cowboy ran and I fired several shots at him, but missed."

After the Navajo had killed the trader, who was shot through the body, he walked up to Wetherill and, after asking him if he was still on the warpath, shot him through the head. Then, riding night and day, the Navajo raced across the reservation and appeared at Shiprock, where he told Superintendent Shelton what he had done. Mr. Shelton delivered the Indian over to the county authorities and the Navajo was put in jail at Aztec. At first he was put under \$10,000 bond. Superintendent Shelton offered to secure ten Indian signers, but objection was made that the Indians could not be held responsible, though many of the Navajos are wealthy. Finally Superintendent Shelton convinced the authorities that the Indian's sense of honor alone would be sufficient to insure his appearance at trial. The Navajo was released practically on his own recognizance, and for the greater part of a year has been at liberty.

The friends of the slain trader claim that they can show that the killing of Mr. Wetherill was unprovoked and that the Indians terrorized the family of the murdered man and drove off stock after the crime had been committed.

Hurry up, run meet him at the gate; it's a P. D. Q. Messenger Boy; they are never late—Ring 113. 19-tfc

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